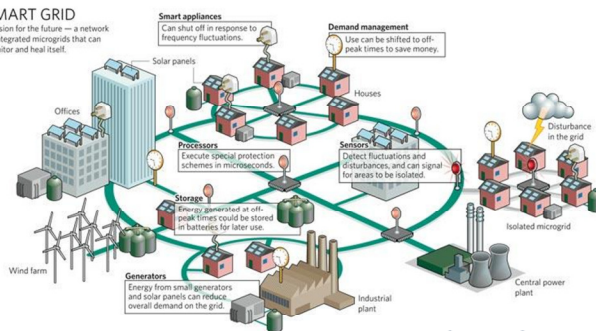


An Introduction - Smart Grid 101

Chapter 4: Metering



SMART GRID
A vision for the future — a network of integrated microgrids that can monitor and heal itself.



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March 2011

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6/16/2011

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The Smart Grid is a compilation of concepts, technologies, and operating practices intended to bring the electric grid into the 21st century. Smart Grid concepts and issues are difficult to address because they include every aspect of electric generation, distribution, and use.

While the scope of smart grid covers the entire utility system from generation to how customers use energy, the three chapters in this portion of the tutorial primarily focus on the intersection between the distribution grid and customer. All elements of smart grid include important engineering, economic, and policy issues. However, with the exception of alternative generation options, the generation and transmission segments are less uncertain and more dominated by engineering economics than the distribution and customer segments.

This Smart Grid 101 tutorial is divided into chapters that address significant individual technical and policy areas. Each chapter attempts to isolate and define technical and policy issues relevant to state regulators. Our objective is to more clearly define the components of Smart Grid, identify how these components interact, and then present information to clarify policy and decision options.

Smart Grid is often considered confusing because it covers not only the entire electric infrastructure but also new technologies, customer interaction, legal, and regulatory issues. To address this problem, each chapter addresses a limited scope of issues derived principally from meetings with regulators, industry literature, and project team professional judgment.

This set of chapters address metering, rate design, and demand response.

4.0 Metering

Objective:

Describe the purpose, functions, and policy issues related to metering for smart grid.

Advanced meters and Smart Meters are the most visible and tangible signs of the Smart Grid. They are installed on and affect every single customer. System implementation involves substantial expenditures and regulatory proceedings that are often controversial.

Rate, billing, accuracy, and reliability problems associated with meter implementation have also generated substantial news and blog coverage regarding numerous consumer, regulatory, and even legislative concerns.

From a regulatory policy perspective, advanced and smart meters associated with Smart Grid raise a number of very diverse and difficult issues, including:

- ❑ Acquisition and implementation of metering systems involve substantial long-term investments that may raise rates and directly impact customer costs. While this tutorial does not address the business case for advanced metering, cost effectiveness is a critical issue.
- ❑ Metering can involve technology that combines industrial and consumer options that have impacts on cost, security and privacy, operational capability, potential premature obsolescence, and the non-utility market for consumer white goods, services, and other devices.
- ❑ Metering provides capability to support changes in rates, pricing, and conditions of service that challenge established practices, interest groups, and long-term system resource requirements.
- ❑ Concerns over health, security, and privacy issues raised by customers, blogs and trade press appear to be increasing and may impact utility AMI implementation, customer choice, and cost effectiveness.

4.01 Metering



Discussion Topics

Section	Slides
4.1 Metering and Smart Grid	4.10 - 4.11
4.2 Advanced Meters versus Smart Meters	4.20 – 4.25
4.3 Policy Issues	4.30 – 4.36
4.4 References	4.37

This chapter is divided into four sections. The slides for each section are listed in the table of contents. Individual slides present references and links to additional resources.

4.10 Metering



What is Electric Metering ?

An electric meter or energy meter is a device that measures the amount of electrical energy consumed by a residence, business, or an electrically-powered device.

Electric meters are typically calibrated in billing units, the most common one being [kilowatt hours](#). Summing kilowatts (kW) over a discrete period of time (hours) provides energy measures (kWh) to support billing. Periodic reading of electric meters establishes billing cycles and energy used during a cycle.

• http://en.wikipedia.org/wiki/Electricity_meter

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An electric meter or energy meter is a device that measures the amount of electrical energy consumed by a residence, business, or an electrically-powered device. *

Electric meters are typically calibrated in billing units, the most common one being the [kilowatt hour](#). Summing kilowatts (kW) over a discrete period of time (hours) provides at least one of the energy metrics to support billing. Periodic readings of electric meters establishes billing cycles and energy used during a cycle.

http://en.wikipedia.org/wiki/Electricity_meter

Meters have always been considered the utility cash register. They provide a very clear point of connection between the utility and customer.

4.11 Metering



Why is metering important to Smart Grid ?

1. Electric meters provide an information link between the utility system (supply) and customer (demand).
2. Meters with integrated communication capabilities are expected to provide essential smart grid functions, including:
 - ☐ More timely usage and status information to the utility to support customer service inquiries, expedite outage detection and restoration, and supplement distribution system volt/VAR management and other functions.
 - ☐ More timely usage information to the customer.
 - ☐ Support for more informative rates, pricing, and demand response options.
3. Advanced metering is a required consideration for all Smart Grid investments under the American Recovery and Reinvestment Act of 2009 of the PURPA Standards in the Energy Independence and Security Act of 2007.

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Why is metering important to Smart Grid?

The conventional electro-mechanical meter was a simple device with a single function – measure cumulative kWh usage to support the billing process. Meters to support Smart Grid will provide sensing and measurement capability to track much more information regarding both the usage and quality of power, and capability to support multiple rate forms. Smart Grid meters will also include communication capability that allow remote access by the utility and even some customers. The meter provides the information link between the utility or supply side of the electric system and the customer or demand side.

To become the more active participant envisioned for Smart Grid, customers will require metering and communication systems that can provide: (1) Rates and pricing that better reflect the dynamic and time-varying changes in energy costs, and; (2) More detailed and timely information to educate themselves on how they use electricity and how they can modify that usage to reduce their costs and environmental impacts.

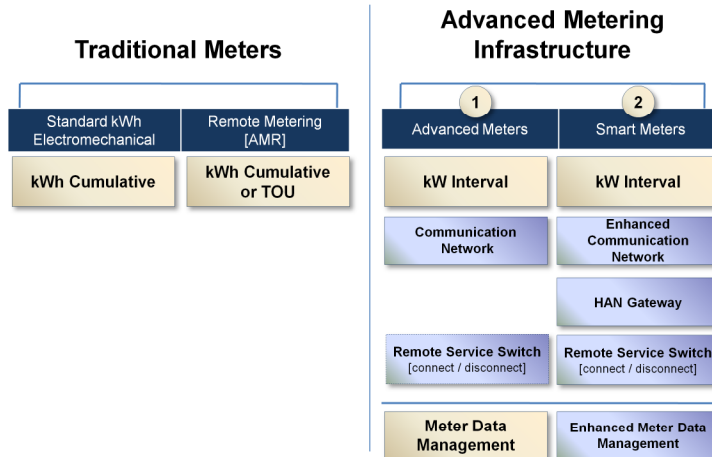
Utilities also need more detailed and timely meter information to support better outage detection, improved load forecasts and fuel purchasing, and more responsive customer services.

Finally, the American Recovery and Reinvestment Act of 2009 requires that states consider requiring utilities to invest in advanced metering even before investing in transmission or distribution systems. (PURPA Standards, Section 1307 111(d). *

4.20 Metering



What are the Smart Grid metering choices?



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What are the Smart Grid metering choices?

Standard meters include conventional electromechanical cumulative meters and multiple register-based meters (used for time-of-use rates) that require a utility technician (or technician employed by utility) to visit or pass by in close proximity to each meter site to periodically capture usage readings. Standard electromechanical or very simple digital meters may also include a low-power radio that can be activated and allow the meter to be read from a passing vehicle (called remote metering or AMR).

There are two general categories of advanced metering infrastructure (AMI) considered capable of supporting smart grid applications: (1) advanced meters and (2) smart metering. Both designs provide interval recording capability and integration with some type of communication system that allows the meter information to be remotely collected on demand by the utility. A remote service switch, also known as a remote connect/disconnect switch, is considered standard on a smart meter and may be optional on an advanced meter.

A smart meter also includes a home area network (HAN) gateway with a low power ZigBee radio (802.15.4). The HAN gateway provides capability for the utility to connect with end-points in the customer premise and support three basic functions: (1) customer access to near real-time meter data, (2) utility provision of price and demand response signals, and (3) utility registration and collection of information from customer end-points to support price and demand response program requirements.

The HAN gateway design was developed to provide added functionality and facilitate a broader range of demand response benefits to improve the business case for advanced metering. Business case enhancements were premised on design features that assume a high degree of utility control over information flows into and out of the customer premise.

For a more complete description of the technical features of the HAN gateway, refer to references #1 and #2 listed on slide 4.50.

4.21 Metering



What is so smart about a “smart meter”?



IEC Meters



ANSI Meters

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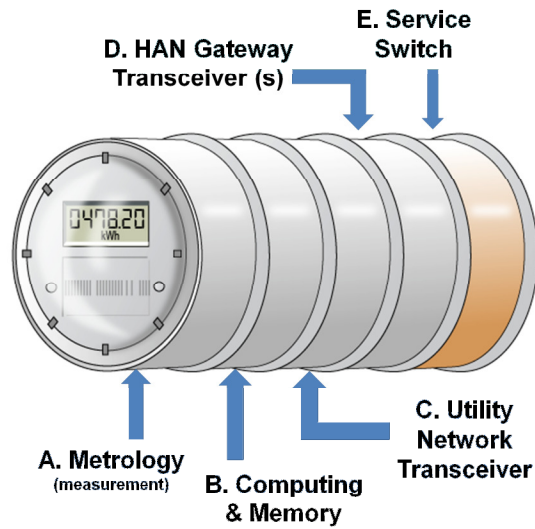
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Advanced and smart meters generally have two basic form factors.

1. Meters which may be installed inside a customer premise, have a rectangular form factor which can often provide expanded displays and function options. These meters are common outside of North America in Europe and Asia.
2. US or North American meters are almost always installed outside the customer premise, using the round form factor.

4.22 Metering



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This is a graphical depiction of the individual physical components that make up a typical advanced and Smart Meter. The advanced meter includes components labeled A, B, and C. The smart meter adds components D and E.

4.23 Metering



Meter Function	Description
A. Metrology	Measure energy usage, voltage, and other values
B. Computing and Memory	<ul style="list-style-type: none">• Supports meter computations, storage of interval data, storage of price or billing metrics, rating periods, billing parameters, storage of customer usage, device, other data.• Support upgrades, bug fixes, security, etc.
C. Utility Network Transceiver (e.g. radio or plc)	Radio /communication components that connect the meter via a network or multiple networks to the utility back office
D. HAN Gateway Transceiver(s)	One or more transceivers to link the Utility Network Transceiver into the customer facility.
E. Service Switch	<ul style="list-style-type: none">• Remote connect / disconnect• Remote whole facility demand limiting

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This table provides a brief description for each of the meter components identified in Slide 4.22.

4.24 Metering



Differences Between Advanced and Smart Metering

- ❑ **Advanced Meters:** a utility-owned or leased communication system that links interval meters at each customer site with back-office meter data management, billing, and other utility application software.
- ❑ **Smart Meters:** Advanced meters with an integrated service switch, HAN gateway, enhanced two-way communications network, and enhanced back office Meter Data Management, Demand Response and Price signaling software.
 - **HAN [home area network]** - communication system(s) within the customer facility that link **consumer-owned** communicating devices including thermostats, pool pumps, appliances, distributed generation sources, gateways, routers, entertainment devices, health monitors, fire, security and other applications.
 - **Service Switch:** a switch that allows the utility to remotely: (a) disconnect and reconnect the customer's electric service and (b) establish a demand limit, which if exceeded will disconnect the customer's electric service.

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Advanced Meters: provide capability to record usage information usually at 5, 15, 30 or 60 minute time intervals. Advanced meters also support functions to monitor meter tampering and service voltage and may provide a service switch with capability to limit demand and remotely connect or disconnect customer service. Advanced meters include a fixed network communication system that allows the utility to remotely query the meter to download meter data or check on service status. Communication can be provided by a variety of architectures and different technologies including powerline, broadband over powerline, conventional telephone lines, and multiple wireless options.

Smart meters: provide the same capability as advanced meters; however smart meters also include two additional functions; (1) a home automation network (HAN) gateway and, (2) a remote service switch which is also known as a remote connect/disconnect switch. These functions require additional hardware and electronics that is physically and electronically integrated into the meter housing.

- ❑ The HAN gateway provides a means for interfacing signals from the utility meter communication network with devices or other networks inside the customer premise.
- ❑ Remote service switches provide capability to remotely turn-off or turn-on all power to a premise. Some service switch designs also provide the utility with capability to remotely set kW load limits for a premise that if exceeded "trip" or turn off all power to the premise.

4.25 Metering



Differences Between Advanced and Smart Meters

Metering System	Advanced	Smart	Tradeoffs - Issues
Primary Function	Interval Recording	Interval Recording, customer messaging	Identical, no issues
Communications Capability	Network, two-way	Network, two-way into customer premise	•Focus on Meter Network •Reach into customer premise
Remotely Configurable Demand Limit Connect, Disconnect Service Switch	• Optional integration • Can be a separate piece of equipment	Integrated	Hardware Integration
▶ Home Area Network Gateway	Separate system or piece of equipment	Partially Integrated	Partial Hardware Integration
▶ Cost Range per Meter [excludes customer devices]	\$70-\$150	\$130-\$250	Cost, Utilization, Depreciation, Obsolescence
Data Collection	Interval kWh	•Interval kWh •Customer device status	•More complex data • Security and Privacy
Rate Forms Supported	Flat, Tiered, TOU, Dynamic	Flat, Tiered, TOU, Dynamic	No issues
▶ Support for Usage Displays	Remote Access Separate Service	Integrated Plus Separate Service	Thru the Meter
Obsolescence Ranking	Low to Moderate	Moderate to Uncertain	Increased Risk
Support for Market Based Devices and Services	Open	"Gate Keeper" Potential	"Smart" May Limit Open Market

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The basic functionality common to both advanced and Smart Meters is compared and contrasted in the accompanying table.

Three major differences between Advanced and Smart metering are flagged with red markers in the left margin, specifically:

- ❑ Home Area Network Gateway: A distinguishing feature of smart meters is the integration of a HAN(Home Area Network) gateway. Advanced Meters do not include an integrated HAN. A HAN could be provided separately from the meter.
- ❑ Cost Range per Meter: Because of the HAN and integrated Service Switch, smart meters can be about twice as expensive as equivalent advanced meters.
- ❑ Support for Usage Displays: The 'ZigBee' radios in the smart meter HAN are expected to be used in conjunction with an in-home display device. The ZigBee radio provides capability to send near real-time meter readings* to a gateway device in the customer premise that can then be linked to any number and variety of in-home displays (IHD). Smart Energy Profile 1.0 (SEP 1.0) is an application loaded into Smart Meters to support ZigBee radio access to meter data. Most utilities with Smart Meters have delayed their use of the HAN gateway and prevented customer access to near real-time meter data until SEP 1.0 can be updated** to address security and interoperability issues.

Advanced meters without supplemental HAN radios cannot provide direct access to near real-time meter data. Supplemental equipment would have to be provided to provide this capability.

* The resolution of meter data is limited by the meter electronics to readings no more frequently than once every 10 seconds.

** SEP 1.0 is being updated by SEP 2.0, which is still in development.

4.30 Metering



Meter-related Policy Issues

Issue	Slides
1. Advanced versus Smart Metering	4.31
2. Health Issues – EMF Radiation	4.32 – 4.34
3. Meter Accuracy	4.35
4. Privacy	4.36
5. Interoperability	4.37

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Almost all regulatory commissions require utilities to present a business case to cost justify their proposed investment in advanced or smart meters. While these business cases provide detailed examinations of expected costs and benefits, they also identify critical operational and policy assumptions underlying the net results.

Implementation of AMI systems often exposes and provides insights or new information on assumptions used in a regulatory proceeding to a broader audience. AMI Implementation almost always also has a tendency to identify unintended consequences which may not have been fully considered or addressed as part of a regular regulatory proceeding.

For example, implementation of advanced and smart meter systems has now raised two sets of meter-related issues not addressed during a typical business case review: (1) health and privacy related issues, and (2) issues related to ongoing technological development.

4.31 Metering



Advanced versus Smart Meter Policy Issues

1. Should there be a demarcation point between the customer and utility?
 - a) Should the utility be collecting data from inside the customer premise?
 - b) Should the meter communication network also be used to support pricing and demand response?
 - c) Should a HAN be incorporated into the residential meter?
2. Should the utility meter communication network be the exclusive channel for price and reliability signals or should this information be broadcast by the utility and/or be made available over one or more other public networks?
3. What are the privacy implications of advanced and Smart Meters and how can they be mitigated?
4. Do advanced meters and smart meters have different obsolescence issues?
5. Should a service switch be integrated into every meter?

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Although they integrate remote communication capability which extends the functionality provided by conventional meters, advanced meter data collection, like that of conventional meters, terminates at the customer service panel. Data collected by advanced meters can be used to support time-dependent and dynamic rates, however data collection does not intrude into the customer premise. **THIS IS A KEY DESIGN FEATURE.**

Smart Meters expand functionality in two ways: (1) operating functions are extended by the HAN into the customer premise and potentially include data collection from individual customer appliances and loads, and; (2) the service switch provides capability to remotely set and limit customer demand and to remotely connect and disconnect electrical service. Differences between advanced and Smart Meters potentially raise five policy issues:

1. Should there be a demarcation point between the customer and utility? Are their liability and competitive issues raised by Smart Meter functionality that extends into the customer premise?
2. Should utilities make price and reliability signals available to the widest audience possible by broadcasting them over a public network or should the meter communication network be designated the exclusive channel for this information? The HAN specification requirements assume the utility meter should be the exclusive gateway into the home for price and reliability signals. Is this a reasonable assumption?
3. How do OpenHAN specifications that require customer to register and allow the utility to monitor appliances impact consumer privacy, in-home network competition, and the markets for smart appliances and control devices? Is device registration and monitoring necessary and if it is, what are the costs and implications of mitigation measures?
4. Are there obsolescence differences between AMI and smart meters and how do they impact the business case? The 'meter' is considered an industrial device while the HAN is a consumer device. Both are subject to different lifetime and competitive expectations.
5. Should a service switch be integrated into every meter? What regulatory policy needs to be established to regulate the use of service switches for turn-on / turn-off and demand response applications?

4.32 Metering



RF Radiation levels from advanced and smart meters pose a health hazard

Arizona
California
Connecticut
Hawaii
Maine
Texas
Wyoming

Ontario, Canada
Victoria, Australia

- ❑ "There's no relief from these signals going through the human body."¹
- ❑ "Smart Meters expose all of us to dangerous microwave like EMF/RF frequency on a continuous basis, that among other things can disrupt the brain, nervous system, endocrine system, immune system and hormones."²
- ❑ "Plants that grow beside Smart Meters die."²
- ❑ "FCC compliance violations are likely to occur under normal conditions of installation and operation of smart meters and collector meters in California."³
- ❑ "There is a huge body of evidence to refute the claim ... that there are no effects from sub-thermal exposures"⁴

1. "Smart Meter Made Me Sick, Mesa Woman Claims", KPHO CBS 6 News, February 22, 2011, <http://www.kpho.com/valleynews/20946007/detail.html>
2. "Worried About Smart Meters", Planet Thrive, February 14, 2011, <http://planetthrive.com/2011/02/worried-about-smart-meters/>
3. "Assessment of Radiofrequency Microwave Radiation Emissions from Smart Meters", Sage Consulting, <http://sagereports.com/smart-meter-rf/>
4. Elihu Richtig, M.D., M.P.H. Hebrew University-Hadassah, Letter to CCST, January 26, 2011, <http://sagereports.com/smart-meter-rf/?p=278>

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In February 2010, some customers of Pacific Gas & Electric Company began raising health concerns with the Radio Frequency (RF) exposure from Smart Meters employing wireless mesh networks. Formal complaints and requests for opt-out relief have been filed with the California Public Utilities Commission and legislation to address the same issue was introduced in the California Legislature (AB37*). In October 2010, similar complaints were filed with the Maine Public Utilities Commission.**

Smart Meters and advanced meters often use wireless networks that make use of low-power radio transmitters embedded in the meter to periodically broadcast meter readings to regional nodes or collectors, which then transmit those readings back to the utility meter data management system. These advanced metering systems may broadcast meter readings one or more times each day. Drive-by metering systems use similar low-power radios to broadcast meter readings to meter readers in vehicles that literally drive by customer premises once each billing cycle.

While RF levels for utility metering systems are measured to be far below FCC standards, the health effects for many individuals cannot be totally dismissed. Neither the FCC or other scientific studies can conclusively state that there are no health effects. The links above and some of the references in Slide #4.50 provide more detail and examples of individual complaints, scientific studies, and related issues.

Slide #4.33 provides a list of several industry studies that measure and compare RF meter system exposure to other RF sources like microwave ovens, cell phones, and home routers. The latest study by EPRI provides detailed measurement and other useful information.

Measures to mitigate meter system related RF effects will generally require a non radio-based or wireless metering solution. Both the California and Maine*** PUC's are currently considering opt-out provisions which would require utilities to provide conventional metering options that require periodic on-site visits by meter readers.

All opt-out alternatives would require the host utility to maintain two separate metering systems. Likely impacts may include increased costs for meter reading, as well as reduced capability to manage system outage detection and restoration, increased customer service costs, and the inability to support solar PV, electric vehicles, and other renewable options for customers that opt-out. A particularly critical issue will be how to recover the increased cost attributed to customers that choose to opt-out.

*http://www.aroundthecapitol.com/Bills/AB_37/20112012/

** http://www.maine.gov/dhhs/boh/documents/Smart_Meters_Maine_CDC_Executive_Summary_11_08_10.pdf

*** <http://www.theforecaster.net/content/pnms-smartmeters-030211>

4.33 Metering



RF Radiation levels from advanced and smart meters do not pose a health hazard

- ❑ "Even if an AMI unit were to continuously operate it would still have exposures in a home far below FCC limits for the public."¹
- ❑ "smart meters ... result in much smaller levels of ... exposure than many ... household ... devices, ... cell phones and microwave ovens"²
- ❑ "The majority of studies indicate that EHS individuals cannot detect EMF exposure any more accurately than non-EHS individuals. Well controlled and conducted double-blind studies have shown that symptoms were not correlated with EMF exposure."³
- ❑ "Irrespective of duty cycle,even multiple units or banks of meters in the same location will be compliant with the public exposure limits."⁴

1. A Perspective on Radio-Frequency Exposure Associated with Residential Automatic Meter Reading Technology, EPRI, February 2010, <http://www.sdge.com/documents/smartmeter/EPRI%20Paper%20on%20RF%20Exposure%20and%20AMR.pdf>
2. Health Impacts of Radio Frequency from Smart Meters, California Council on Science and Technology, January 2011, <http://www.ccsst.us/publications/2011/2011smartA.pdf>
3. Electromagnetic fields and public health, World Health Organization, Fact Sheet N 296, December 2005, <http://www.who.int/mediacentre/factsheets/fs296/en/index.html#>
4. FCC letter to Cindy Sage, Compliance Review Request of March 15, 2010, Smart Meter RF Exposure Limits, August 8, 2010.

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Please see the previous slide (#4.32) for a basic explanation of the problem.

4.34 Metering



RF Radiation levels from advanced and smart meters Policy Issues and Options

While scientific evidence overwhelmingly concludes there is no problem, health science is inconclusive that no individuals will not experience negative side effects.

Policy Issues

- ☐ Should advanced meters be mandatory or voluntary?
- ☐ How do you craft a potential opt-out option that does not undermine either the advanced metering business case or utility system smart grid operations?
- ☐ How should the cost of any opt-out provision be allocated?
 - Costs should be allocated to those that opt-out, or
 - Costs should be “socialized” and distributed across all customers.
- ☐ What implications does an metering opt-out provision have for rate, demand response, electric vehicle, and other smart grid initiatives?

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While the scientific evidence and history of drive-by metering systems seem to indicate that there is no scientific or engineering basis for the current RF health-related problems, the health science information is inconclusive. As a result, it is likely that regulatory or even legislative action may be necessary to address the issue.

One solution being proposed is an opt-out strategy which would require utilities to provide customers with a meter that does not include any wireless communicating capability. This arrangement introduces several key regulatory questions, where the resolution can have significant operational and cost implications. Key questions include:

- ☐ Should advanced meters be mandatory or voluntary?
- ☐ How do you craft a potential opt-out option that does not undermine either the advanced metering business case or utility system smart grid operations?
- ☐ How should the cost of any opt-out provision be allocated?
 - Costs should be allocated to those that opt-out, or
 - Costs should be “socialized” and distributed across all customers.
- ☐ What implications does an metering opt-out provision have for rate, demand response, electric vehicle, and other smart grid initiatives?

4.35 Metering



Meter Accuracy

- ❑ "A California man has filed suit against Pacific Gas & Electric Company (PG&E), alleging that the company's "Smart Meter" program consistently overcharges him for gas and electric services."¹
- ❑ The lawsuit alleges that the "Smart" Meter systems installed by Oncor are improperly overcharging hard-working Texans for their consumption of electricity.
- ❑ "...Texas PUC Chairman Barry Smitherman said that the "extraordinary and comprehensive study clearly shows the superiority of smart meters compared to traditional, electromechanical meters."³
- ❑ "Structure concluded that the residential electric Smart Meters deployed by PG&E are consistent with industry standards and are performing accurately."⁴

1. Class Action Accuses PG&E of Overcharges, ConsumerAffairs.com, November 8, 2009, <http://www.consumeraffairs.com/news/4/2009/11/pg-e-suit.html>
2. Oncor "Smart Meter" Lawsuit, March 26, 2010, <http://oncorlawsuit.com/>
3. Post #34 – Smart Meters Pass a Test in Texas, August 5, 2010, <http://geraldrichmansmartgrid.blogspot.com/2010/08/post-34-smart-meters-pass-test-in-texas.html>
4. Structure Announces Findings of PG&E Smart Meter Assessment, September 2, 2010, <http://www.thestructuregroup.com/structure-announces-findings-of-pge-smart-meter-assessment>

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In the summer of 2009 PG&E was just ramping up their installation of 10 million Smart Meters when high bill complaints from Tuolumne County and Bakersfield began to register. Individual consumers and consumer groups filed complaints with the CPUC claiming these new meters were inaccurate. In the years since those first complaints, similar problems have been reported from utilities in Texas, Maine, Connecticut, Nevada and Ontario, Canada.

The California and Texas Public Utility Commissions separately required their utilities to conduct detailed studies to understand both the underlying reasons for and scope of the problems (see links above). While each of these studies identified a very small percentage of installation errors, both studies concluded that advanced and smart meters were accurate and capable of providing accurate billing.

"It is Navigant Consulting's opinion, with consideration given to certain issues described below, that the vast majority of advanced meters installed by Oncor, CenterPoint and AEP Texas are accurately measuring and recording electric usage, as well as communicating that information through the respective advanced metering systems for use in customer billing." (Slide 4.50, Reference #3, pg 14).

Both the California and Texas studies also evaluated the accuracy of customer billing. No fundamental billing problems were identified.

4.36 Metering



Privacy

- ❑ “NIST found that the existing business policies and practices of utilities and third-party smart grid providers may not adequately address the privacy risks created by smart meters and smart appliances.”¹
- ❑ Should a utility, for example, have the right to know I'm using my air conditioner during a peak load time?²
- ❑ “if you don't need (certain data), don't collect it.”³

Areas of Concern

- Customer device data collection
- Data Custodial Relationship
- Third-party Access

1. Demand Response and Advanced Metering, Staff Report, FERC, February 2011, p15, <http://www.ferc.gov/legal/staff-reports/2010-dr-report.pdf>
2. How Private is Your Smart Grid Data?, Usman Sindhu, Harvard Business Review, Blog, October 13, 2010, http://blogs.hbr.org/cs/2010/10/how_private_is_your_smart_grid.html
3. Sue Kelley, American Public Power Association, PLMA Webcast, February 17, 2011.

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Along with the health, meter accuracy, and billing problems, privacy issues related to the collection, management and use of metering data have been raised by individual customers, consumer groups, several government panels/organizations, and the NIST Smart Grid Interoperability Panel – Cyber Security Working Group.

Privacy issues center around the collection and management of detailed interval meter data from individual customer meters. Of particular concern is utility collection of personally identifiable information (PII) – information that describes individuals, groups of individuals, households, or residences, which also can include energy use patterns. While the privacy issues and mitigation measures are very complex, the key issues and concerns fall into the following categories:

- ❑ Detailed interval data collected at 15-60 minute intervals can be used to identify household occupancy, lifestyle habits, and actual appliance usage – which potentially compromise customer privacy and safety
- ❑ Smart meter registration of individual customer appliances further accentuates customer privacy issues.
- ❑ Data ownership, custodial relationships, and third-party access to customer data introduce a range of privacy issues.

Key issues regarding privacy are outlined in detail in several recent reports* and in smart grid proceedings conducted by the California Public Utilities Commission in a series of workshop in November 2010.**

- http://www.gc.energy.gov/documents/Broadband_Report_Data_Privacy_10_5.pdf
- http://docs.cpuc.ca.gov/proceedings/R0812009_doc.htm, (Documents for November 8, 2010).

4.37 Metering



Interoperability

“Recently, utilities that installed meters that include integrated home area network (HAN) components have raised concerns that their meters may become obsolete if the industry adopts communication protocols for appliances and other components that are incompatible with their meters.”*

Areas of Concern

- System interoperability
- Business Case
- Market model for customer automation
- Third-party services

* Demand Response and Advanced Metering, Staff Report, FERC, February 2011, p19.
<http://www.ferc.gov/legal/staff-reports/2010-dr-report.pdf>

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Slides 4.20 – 4.25 identify several key differences between advanced meters and Smart Meters. The main difference is the HAN gateway included in Smart Meters. The HAN gateway is characterized as a consumer device whose function is to link appliances and loads within the customer premise with the utility meter and meter communication system. Consumer devices are generally subject to highly competitive markets with multiple suppliers, where features and prices can change very quickly and where development and new product cycles are measured in months, not years. In contrast, the basic electric meter inherent in advanced and smart meters is characterized as an industrial device, where functionality is relatively stable over long periods of time (years), there are few suppliers, costs change slowly, and replacements are infrequent.

The HAN gateway designed into Smart Meters included a dependence on ZigBee Smart Energy Profile (SEP 1.0) and assumptions that few other alternatives would emerge to address energy management applications for residential and small commercial electric loads. The business case (cost benefit) for Smart Meters for many utilities is very dependent on both of these assumptions.

As the quote above illustrates, both of these assumptions are now being challenged. Because of security, privacy, and interoperability issues with SEP 1.0, utilities have delayed HAN applications until SEP 2.0 becomes available.* In addition, smart appliance and other products and applications are already being introduced into the market that take advantage of existing Internet capability, completely independent of the Smart Meter HAN gateway. Dejour standards like OpenADR* and interoperability options like Usnap** are also being introduced.

While the Smart Meter HAN gateway will undoubtedly provide useful functionality, substantial market competition is already evident.

• <http://openadr.lbl.gov/>

** <http://www.usnap.org/>

4.40 Metering



References

	Title	Link
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2	UtilityAMI 2008 Home Area Network System Requirements Specification	http://osgug.uciucg.org/spsystems/openhan/Shared%20Documents/UtilityAMI%20HAN%20SRS%20-%20v1.04%20-%20080819-1.pdf
3	Evaluation of Advanced Metering System (AMS) Deployment in Texas, Report of Investigation, July 30, 2010	Document 38053, http://interchange.puc.state.tx.us/WebApp/Interchange/application/d/bapps/billings/pgDailySearchResults.asp?TEXT_UTILITY_TYPE=E&TEXT_D_FROM=07/30/10&TEXT_D_TO=07/30/10
4	Advanced Metering Assessment Report, Commissioned by the California Public Utilities Commission, September 2, 2010	http://www.cpuc.ca.gov/NR/rdonlyres/2B0BA24E-E601-4739-AC8D-DA9216591913/0/StructureExecutiveSummary.pdf
5	MAINE CDC EXECUTIVE SUMMARY OF REVIEW OF HEALTH ISSUES RELATED TO SMART METERS , November 8, 2010	<ul style="list-style-type: none"> http://www.maine.gov/dhhs/boh/documents/Smart_Meters_Maine_CDC_Executive_Summary_11_08_10.pdf http://www.maine.gov/dhhs/boh/documents/Smart_Meters_Review_of_Government_Resources_11_08_10.pdf http://www.maine.gov/dhhs/boh/documents/smart-meters-faq.pdf
6	PG&E Advanced Metering Assessment Report Commissioned by the California Public Utilities Commission, September 2, 2010	http://www.cpuc.ca.gov/NR/rdonlyres/2B0BA24E-E601-4739-AC8D-DA9216591913/0/StructureExecutiveSummary.pdf
7	Murderous Microwaves, IEEE Spectrum, March 2011	http://spectrum.ieee.org/telecom/wireless/murderous-microwaves/?utm_source=scholar&utm_medium=email&utm_campaign=939311

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